Remarks

Thorough examination by the Examiner is noted and appreciated.

The claims have been amended and new claims added to clarify Applicants disclosed invention.

Support for the new claims is found in the Specification, the Figures and the original claims.

No new matter has been added.

For example support for the amendments and new claims is found in the Specification at:

Paragraphs 0028:

"The present invention contemplates a method which includes providing a seasoning film of high oxygen content on the interior surfaces of a process chamber, particularly a CVD chamber. **The seasoning film reduces the quantity of residual process particles which remain in the chamber after chemical vapor deposition processes are carried out in the chamber.** This reduces the quantity of contaminating particles which are available to contaminate layers deposited on substrates in subsequent processes. Consequently, the incidence of defects in device features fabricated on substrates is substantially decreased, thereby promoting the WAT (wafer acceptance testing) yield."

Paragraphs 0037 and 0038:

"In typical operation of the CVD process chamber 10 to deposit a material layer or layers on a substrate 24, the substrate 24 is initially placed on the pedestal 22. Deposition gases are introduced into the chamber interior 13 through the showerhead 14 and ignited to form **a plasma** which contacts the substrate 24 to **deposit material layers** thereon. In the fabrication of gate stack structures which are characteristic of MOSCAP (metal oxide semiconductor capacitor) structures and MOSFET (metal oxide semiconductor field effect transistor) structures, for example, **amorphous silicon or polysilicon** is deposited on a high-k dielectric material layer.

During the deposition process, silicon or other material residues become deposited on the interior surfaces, including those of the chamber wall 12, of the chamber 10. Typically, these **silicon residues are removed by introducing etchant HCl** or other etchant cleaning gas into the chamber interior 13 through the showerhead 14, such that the HCl or other etchant cleaning gas contacts the interior surfaces of the chamber 10 and removes the silicon residues from those surfaces to eliminate or minimize the risk of contaminating devices that are subsequently fabricated on substrates 24. However, the HCl or other etchant cleaning gas is typically incapable of removing all of the silicon or other material residues from the interior surfaces of the chamber 10."

Paragraphs 0042 and 0043:

"As indicated in step 4 of Figure 2, after the seasoning film 30 has

been deposited on the interior surfaces of the chamber 10, layer-forming precursor gases and by-products which remain in the chamber 10 are evacuated therefrom typically by operation of the vacuum pump 20. Accordingly, the chamber 10 is seasoned or primed for CVD processing of substrates 24 therein, and a substrate 24 is placed on the pedestal 22, as shown in step 5, for processing, as shown in step 6. After completion of the CVD process, the substrate 24 is removed from the chamber 10, as shown in step 7.

During the CVD deposition process of step 5, the seasoning **film 30 repels the formation of amorphous silicon** and other material residues **on the interior surfaces of the chamber** 10. Therefore, after competion of the CVD deposition process, these residues are readily evacuated from the chamber 10 with the remaining process gases using the vacuum pump 20."

Claim Rejections under 35 USC 112

1. Claims 1, 3-6, 8-10, 12, and 13 stand rejected under 35 USC 112, first paragraph, as failing to comply with the written description requirement. Examiner asserts that "nitrogen-containing gas" and "carbon-containing gas" amount to a broad genus of gases not supported by Applicants disclosure since only carbon dioxide is disclosed as the "carbon containing gas" and only ammonia is disclosed as a "nitrogen-containing gas".

Applicants respectfully refer Examiner to paragraph 0040 of Applicants Specification:

"Next, as shown in step 3, the seasoning film precursor gases are introduced into the chamber interior 13, typically through the showerhead 14. In one embodiment, in which the seasoning film 30 is silicon dioxide (SiO_2), the **silicon precursor gas** is silane (SiH_4) and the **oxygen precursor gas** is O_2, N_2O, NO, CO_2 or other suitable oxygen-containing precursor gas. In another embodiment, in which the repellent coating layer 30 is silicon nitride (Si_3N_4), the silicon precursor gas is dichlorosilane ($SiCl_2H_2$) and the **nitrogen precursor gas** is ammonia (NH_3). In still another embodiment, in which the repellent coating layer 30 is silicon carbide (SiC), the **silicon precursor gas** is trimethylsilane [$Si(CH_3)_3H$] and the **carbon precursor gas** is carbon dioxide (CO_2)."

Thus Applicants have **explicitly** disclosed and taught "nitrogen containing gas" and "carbon containing gas" by the respective terms "nitrogen precursor gas" and "carbon precursor gas".

Examiner is further directed to the case law.

> On the other hand, there may be situations where one species adequately supports a genus. See, e.g., *Rasmussen*, 650 F.2d at 1214, 211 USPQ at 326-27.
>
> ("[W]here no explicit description of a generic invention is to be found in the specification * * * mention of representative compounds may provide an implicit description upon which to base generic claim language.", *In re Robins*, 429 F.2d 452, 456-57, 166 USPQ 552, 555 (CCPA 1970).

> **As long as the specification discloses at least one method for making and using the claimed invention that bears a reasonable correlation to the entire scope of the claim, then the enablement requirement of 35 U.S.C. 112 is satisfied.** *In re Fisher*, 427 F.2d 833, 839, 166 USPQ 18, 24 (CCPA 1970).

Thus, in this case Applicants have **explicitly** provided support for the claim language of "nitrogen containing gas" and "carbon containing gas" **as well as** having disclosed **representative species.**

Examiner has not explained why, or provided support for the notion that one of ordinary skill in the art would not understand that "nitrogen containing gas" and "carbon containing gas" are taught by the terms "nitrogen precursor gas" and "carbon precursor gas", and thus, Examiner has failed to make out a *prima facie* case that Applicants disclosure fails to satisfy with the written description requirement:

See MPEP 2163.04(I):

> In rejecting a claim, the examiner must set forth express findings of fact which support the lack of written description conclusion (see MPEP § 2163 for examination guidelines pertaining to the written description requirement). These findings should:
>
> (A) Identify the claim limitation at issue; and

(B) Establish a *prima facie* case by providing reasons why a person skilled in the art at the time the application was filed would not have recognized that the inventor was in possession of the invention as claimed in view of the disclosure of the application as filed.

Claim Rejections under 35 USC 103

1. Claims 1 and 2 stand rejected under 35 USC Section 103(a) as being unpatentable over Murugesh et al.(US 5,811,356) in view of Rajagopalan et al.(US 6,274,058), Hander et al.(US 6,403,501), and Ying et al. (USPUB 2003/0013314) et al.

Murugesh et al. disclose a process **for reducing the concentration of mobile ion and metal contaminants** appearing in a subsequently **deposited SiO2 layer** on a substrate where the mobile **metal contaminants originate from** (leached out) of **chamber metal components** (see Abstract; col 2, lines 12-25). The method of Murugesh et al. disclose first cleaning the process chamber with plasma cleaning gases comprising **fluorinated compounds** (col 4, lines 65 ~ col 5, line 2; claim 2)), followed by deposition of a seasoning layer on chamber components where the **seasoning layer**

is disclosed to be **silicon dioxide** (col 5, lines 9-15; lines 40-44; col6, lines 47-59) claims 6, 17), **silicon oxyfluoride (SiOF)** (col 3, lines 5-10;claims 8, 17), **doped or undoped silicate glass** (Figure 3;claims 4,5,16). Murugesh et al. disclose an exemplary process for depositing silicon dioxide using **silane and oxygen** plasma source gases, but discloses that other recipes used in **HDP** processes (i.e., for depositing SiO2) may be used. Murugesh et al. also disclose that the **same recipe should be used in the seasoning step as the substrate deposition step** (i.e., SiO2 layer) (col 5, lines 20-25).

Murugesh et al. disclose that the mobility of the contaminants **through the SiO2 film** is a function of the size of the atom (contaminant) and the diffusivity of the atom (contaminant).

Murugesh et al. achieve the goal of their invention (reducing diffusion of contaminants from chamber components through SiO2 films) by increasing the RF bias during forming the seasoning SiO2 layer or by carrying out the deposition process to deposit the seasoning SiO2 layer for a longer period of time depending on the contaminant metal (col 4, lines 50-64. In

either case, **a thicker SiO2 seasoning film results** which is believed may be the reason for the reduction of contaminants originating from the **chamber metal components** in a subsequent SIO_2 deposition process(e.g., wall) (col 10, lines 32-45; col 6, lines 1-46).

Nowhere do Murugesh et al. suggest or disclose the deposition of material layers other than SiO2, SiOF, and doped or undoped silicate glass or disclose or suggest that any other types of material layers may be more suitable for stopping the migration of mobile metal contaminants from chamber components.

On the other hand, Rajagopalan et al. disclose a process for **cleaning deposits from and HDP-CVD chamber using a remotely generated plasma**. Rajagopalan et al. also discloses that forming a seasoning layer **to remove residual contamination** is particularly important where **fluorine cleaning gases** have previously been used in order to prevent fluorine contamination in a subsequent deposition process disclosed as a tantalum pentaoxide seasoning layer (HDP-CVD) process in a tantalum deposition chamber.

In contrast, Hander disclose a process for forming a **doped dielectric seasoning layer disclosed to be fluorosilicate glass** (FSG) **on the chamber walls prior to depositing a fluorosilicate glass layer** on a substrate in and **HDP-CVD** process **in order to maintain an equilibrium of fluorine species** to maintain a **consistent deposition rate of the fluorosilicate glass** (see Abstract). Hander also teaches that the **thickness of the seasoning film** relative to the thickness of the deposited layer on the substrate **is important in order to keep an equilibrium of fluorine species** present during a deposition process and over a number of desired depositions to maintain a consistent deposition rate. Contrary to what Examiner asserts, Hander discloses forming the seasoning layer 10 to 30 microns thick and a thin layer of FSG on the substrate of 1 to 3 microns (see e.g., claim 10).

In further contrast, Ying et al. disclose a completely different process than Murugesh et al., Rajagopalan et al., or Hander, **where a seasoning layer is deposited** on the **metal etch chamber walls** by **treating a substrate** (iridium) **to one of the etchant gases** (BCl3, HBr, and CF4), **prior to a metal** (iridium) **etching process** in order to **entrap subsequently generated metal etching residues** (non-volatile byproducts) on the chamber walls

in a subsequent etching process (see Abstract; paragraph 0014-0017; 0019-0020).

Thus, there appears to be no apparent motivation to combine the disparate teachings of Murugesh et al., with Rajagopalan et al., or Hander, or Ying et al., other than an effort to recreate Applicants invention.

For example the teaching of Hander et al. in **maintaining an equilibrium of fluorine species** to deposit an SiOF layer is inconsistent with the teachings (principle of operation) of Rajagopalan et al. **to prevent fluorine contamination** in a tantalum deposition process. Moreover, the teachings of both Hander et al. and Rajagopalan et al., as well Murugesh et al. are inconsistent with the teaching (principle of operation) of Ying et al. in forming a seasoning layer (including chlorine and fluorine) for **entrapping metal byproducts** on the chamber walls in a **subsequent metal etching process**.

Nevertheless, even assuming *arguendo*, a proper motivation for combining the above teachings, such combination does not produce Applicants disclosed and claimed invention.

For example, the combined references do not teach Applicants claimed pressures, as one of ordinary skill would understand that HDP-CVD processes (High density plasmas), as disclosed by the cited references, cannot be carried out at Applicants claimed pressures.

In addition, none of the references suggests or discloses a solution to the problem that Applicants have recognized and solved by their disclosed and claimed invention:

"A method of seasoning a process chamber having interior surfaces **to reduce the formation of silicon residues on said interior surfaces in a subsequent silicon deposition process**"

None of the references discloses or suggests forming a seasoning layer for a subsequent silicon plasma deposition process or disclose a cleaning process using a chlorine etchant gas prior to a silicon plasma deposition process, or suggest or disclose a solution to the problem that Applicants have provided by their disclosed and claimed invention.

"Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure." *In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).*

"If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims prima facie obvious." *In re Ratti, 270 F.2d 810, 123, USPQ 349 (CCPA 1959).*

"we do not pick and choose among the individual elements of assorted prior art references to recreate the claimed invention, but rather we look for some teaching or suggestion in the references to support their use in a particular claimed combination". Symbol Technologies, Inc. v. Opticon, Inc., 935 F.2d 1569, 19 USPQ2d 1241 (Fed. Cir. 1991).

2. Claims 5-7, 10, and 11 stand rejected stand rejected under 35 USC Section 103(a) as being unpatentable over Murugesh et al.,

above in view of Yoo et al. (US 6,479,098) in further view of Rajagopalan et al., Hander et al., and Ying et al.

Applicants reiterate the comments made above with respect to Murugesh et al., Rajagopalan et al., Hander et al., and Ying et al.

Statement of Common Ownership Pursuant to 35 USC 103(c)

Applicants attorney of record state that Yoo et al. (US 6,479,098) and Applicants instant application were, at the time the invention was made, owned by Taiwan Semiconductor Manufacturing Company. Therefore, Examiners use of Yoo et al. as a reference in a 103(a) rejection appears to be improper under 35 USC §103(C).

However, while not agreeing Yoo et al. may be properly be used as a reference in a rejection under 103(a), assuming *arguendo* that it is a properly used reference, Applicants respectfully traverse Examiner's rejection under 35 U.S.C. 103(a).

The fact that Yoo et al. teach depositing a composite seasoning layer (USG/FSG/USG) on the interior surfaces of a CVD chamber (including a gas distribution plate) in order to stop mobile metal species originating from the chamber walls as well as improving a time between chamber cleaning processes in **an FSG deposition chamber** (see Abstract), does not further help Examiner in establishing a prima facie case of obviousness.

"Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure." *In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).*

3. Claim 3 stands rejected stands rejected under 35 USC Section 103(a) as being unpatentable over Murugesh et al., above in view Rajagopalan et al., Hander et al., and Ying et al., above, and further in view of Tsai(US 5891,799) and either Xi et al. (US6,323,119) or Rossman et al. (US 6,121,161).

Applicants reiterate the comments made above with respect

to Murugesh et al., Rajagopalan et al., Hander et al., and Ying et al.

Even assuming *arguendo*, that Tsai is *analogous* art, and a proper motivation for combination, the fact that Tsui et al. teach depositing a silicon nitride film using dichlorosilane and ammonia **to form a hardmask layer over an ILD layer in a via etching process**, does not further help Examiner in producing Applicants disclosed and claimed invention or establishing a *prima facie* case of obviousness.

On the other hand, the fact that Xi et al., teaches an FSG seasoning film **to prevent outgassing of fluorine** from the chamber walls where the **film has a thickness of about 100 Angstroms** thick and discloses that the film may be **silicon nitride, silicon oxynitride or FSG** prior to depositing an **amorphous fluorocarbon** film on a substrate, does not further help Examiner in producing Applicants disclosed and claimed invention or establishing a *prima facie* case of obviousness.

In contrast to Xi et al., Rossman et al. teach forming a protective film of **SiN, SiON, or PSG on an SiO2 seasoning layer**

on an interior of an **HDP-CVD deposition chamber (see title)** to prevent mobile metal ions originating from the metal chamber components (similar to Murugesh et al.) from becoming contaminants in an **HDP-CVD deposition process** taught to be particularly useful for improving the quality of **deposited USG films**, and where **the addition of the protective layer is** taught to be superior to silicon dioxide alone in preventing diffusion of sodium (Na) ions from chamber components through the SiO2 layer. Rossman et al teach forming SiN with plasma source gases of **nitrogen (N2) and silane (SiH4)** and SiO2 with **plasma source gases of silane and oxygen.**

Even assuming *arguendo*, a proper motivation for combination, the fact that Rossman et al. teach forming a SIN or SION **protective layer over an SIO2 seasoning layer** on an HDP-CVD deposition chamber interior to produce high quality USG films, does not further help Examiner in producing Applicants disclosed and claimed invention or establishing a *prima facie* case of obviousness.

"Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The

teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure." *In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).*

"we do not pick and choose among the individual elements of assorted prior art references to recreate the claimed invention, but rather we look for some teaching or suggestion in the references to support their use in a particular claimed combination". Symbol Technologies, Inc. v. Opticon, Inc., 935 F.2d 1569, 19 USPQ2d 1241 (Fed. Cir. 1991).

4. Claim 4 stands rejected under 35 USC Section 103(a) as being unpatentable over Murugesh et al., above in view of Hander et al. and Ying et al., above, and further in view of Tsai(US 5891,799) and further in view of Lee et al.(US 6,890,850) and Boeglin (US 5,061, 514).

Applicants reiterate the comments made above with respect to Murugesh et al., Hander et al., Ying et al., and Tsai.

Even assuming *arguendo*, that Lee et al. is *analogous* art, and assuming *arguendo* a proper motivation for combination, the

fact that Lee et al. teach a method of forming a silicon carbide film including **passivating the chamber with a silicon carbide coating prior to depositing layers of silicon carbide on a wafer,** using a **di-tert-butylsilane vapor** (see Abstract) and where the prior art discloses a **CVD process** using **trichloromethylsilane,** does not further help Examiner in producing Applicants disclosed and claimed invention or establishing a *prima facie* case of obviousness.

Even assuming *arguendo,* that Boeglin is *analogous* art, and a proper motivation for combination, the fact that Boeglin teaches a method of forming an **oxygen doped silicon carbide layer as a hardmask or a barrier layer** (see Abstract) on a substrate, does not further help Examiner in producing Applicants disclosed and claimed invention or establishing a *prima facie* case of obviousness.

"Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure." *In re Vaeck, 947*

F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

"we do not pick and choose among the individual elements of assorted prior art references to recreate the claimed invention, but rather we look for some teaching or suggestion in the references to support their use in a particular claimed combination". Symbol Technologies, Inc. v. Opticon, Inc., 935 F.2d 1569, 19 USPQ2d 1241 (Fed. Cir. 1991).

5. Claim 8 and 12 stand rejected stands rejected under 35 USC Section 103(a) as being unpatentable over Murugesh et al., above in view of Yoo et al., and further in view of Rajogopalan et al., Hander et al., and Ying et al., above, and further in view of Tsai (US 5,891,799) and further in view of Tsui, above, and either Xi et al. or Rossman above.

Applicants reiterate the comments made above with respect to Murugesh et al., Yoo et al., Rajogopalan et al., Hander et al., Ying et al., Tsai, Tsui, Xi et al. and Rossman et al.

6. Claim 9 and 13 stand rejected stands rejected under 35 USC Section 103(a) as being unpatentable over Murugesh et al., above in view of Yoo et al., and further in view of Rajogopalan et al.,

Hander et al., and Ying et al., above, and further in view of Tsai, and further in view of Lee et al., above, and Boeglin, above.

Applicants reiterate the comments made above with respect to Murugesh et al., Yoo et al., Rajogopalan et al., Hander et al., Ying et al., Tsai, Lee et al., and Boeglin.

Conclusion

The multiplicity of cited references (10), singly or in combination, fail to produce Applicants disclosed and claimed invention or recognize or provide a solution to the problem that Applicants have recognized and solved by their disclosed and claimed invention thus failing to make out a *prima facie* case of obviousness.

Applicants have amended their claims and added new claims to clarify Applicants invention and clearly define over the prior art.

Based on the foregoing, Applicants respectfully submit that all of Applicants Claims are now in condition for allowance. Such

favorable action by the Examiner at an early date is respectfully solicited.

In the event that the present invention as claimed is not in a condition for allowance for any other reasons, the Examiner is respectfully invited to call the Applicants' representative at his Bloomfield Hills, Michigan office at (248) 540-4040 such that necessary action may be taken to place the application in a condition for allowance.

Respectfully submitted,

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